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exceed -147 dB (W/m²/100 MHz) for all angles of arrival.

[49 FR 2373, Jan. 19, 1984]

EDITORIAL NOTE 1: For FEDERAL REGISTER citations affecting § 2.106, see the List of CFR Sections Affected, which appears in the Finding Aids section of the printed volume and on GPO Access.

§ 2.107 Radio astronomy station notification.

(a) Pursuant to No. 1492 of Article 13 and Section F of Appendix 3 to the international *Radio Regulations* (Geneva, 1982), operators of radio astronomy stations desiring international recognition of their use of specific radio astronomy frequencies or bands of frequencies for reception, should file the following information with the Commission for inclusion in the Master International Frequency Register:

(1) The center of the frequency band observed, in kilohertz up to 28,000 kHz inclusive, in megahertz above 28,000 kHz to 10,500 MHz inclusive and in gigahertz above 10,500 MHz.

(2) The date (actual or foreseen, as appropriate) when reception of the frequency band begins.

(3) The name and location of the station, including geographical coordinates in degrees and minutes.

(4) The width of the frequency band (in kHz) observed by the station.

(5) The antenna type and dimensions, effective area and angular coverage in azimuth and elevation.

(6) The regular hours of reception (in UTC) of the observed frequency.

(7) The overall receiving system noise temperature (in kelvins) referred to the output of the receiving antenna.

(8) The class of observations to be taken. Class A observations are those in which the sensitivity of the equipment is not a primary factor. Class B observations are those of such a nature that they can be made only with advanced low-noise receivers using the best techniques.

(9) The name and mailing address of the operator.

(b) The permanent discontinuance of observations, or any change to the information above, should also be filed with the Commission.

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(c) Observations being conducted on frequencies or frequency bands not allocated to the radio astronomy service should be reported as in paragraph (a) of this section for information purposes. Information in this category will not be submitted for entry in the Master International Frequency Register and protection from interference will not be afforded such operations by stations in other services.

§ 2.108 Policy regarding the use of the fixed-satellite allocations in the 3.6–3.7, 4.5–4.8, and 5.85–5.925 GHz bands.

The use of the fixed-satellite allocations in the United States in the above bands will be governed by footnote US245. Use of the fixed-satellite service allocations in these bands is for the international fixed-satellite service, that is, for international inter-continental communications. Case-by-case electromagnetic compatibility analysis is required with all users of the bands. It is anticipated that one earth station on each coast can be successfully coordinated. Specific locations of these earth stations depend upon service requirements and case-by-case EMC analyses that demonstrate compatible operations.

Subpart C—Emissions

§ 2.201 Emission, modulation, and transmission characteristics.

The following system of designating emission, modulation, and transmission characteristics shall be employed.

(a) Emissions are designated according to their classification and their necessary bandwidth.

(b) A minimum of three symbols are used to describe the basic characteristics of radio waves. Emissions are classified and symbolized according to the following characteristics:

(1) First symbol—type of modulation of the main character;

(2) Second symbol—nature of signal(s) modulating the main carrier;

(3) Third symbol—type of information to be transmitted.

NOTE: A fourth and fifth symbol are provided for additional information and are shown in Appendix 6, part A of the ITU Radio

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Regulations. Use of the fourth and fifth symbol is optional. Therefore, the symbols may be used as described in Appendix 6, but are not required by the Commission.

(c) First Symbol—types of modulation of the main carrier:

- | | |
|---|---|
| (1) Emission of an unmodulated carrier | N |
| (2) Emission in which the main carrier is amplitude-modulated (including cases where sub-carriers are angle-modulated): | |
| —Double-sideband | A |
| —Single-sideband, full carrier | H |
| —Single-sideband, reduced or variable level carrier | R |
| —Single-sideband, suppressed carrier | J |
| —Independent sidebands | B |
| —Vestigial sideband | C |
| (3) Emission in which the main carrier is angle-modulated: | |
| —Frequency modulation | F |
| —Phase modulation | G |

NOTE: Whenever frequency modulation “F” is indicated, Phase modulation “G” is also acceptable.

- | | |
|---|---|
| (4) Emission in which the main carrier is amplitude and angle-modulated either simultaneously or in a pre-established sequence .. | D |
| (5) Emission of pulses: ¹ | |
| —Sequence of unmodulated pulses | P |
| —A sequence of pulses: | |
| —Modulated in amplitude | K |
| —Modulated in width/duration .. | L |
| —Modulated in position/phase .. | M |
| —In which the carrier is angle-modulated during the period of the pulse | Q |
| —Which is a combination of the foregoing or is produced by other means | V |
| (6) Cases not covered above, in which an emission consists of the main carrier modulated, either simultaneously or in a pre-established sequence, in a combination of two or more of the following modes: amplitude, angle, pulse ... | W |
| (7) Cases not otherwise covered ... | X |

¹Emissions where the main carrier is directly modulated by a signal which has been coded into quantized form (e.g. pulse code

(d) Second Symbol—nature of signal(s) modulating the main carrier:

- | | |
|--|---|
| (1) No modulating signal | 0 |
| (2) A single channel containing quantized or digital information without the use of a modulating sub-carrier, excluding time-division multiplex | 1 |
| (3) A single channel containing quantized or digital information with the use of a modulating sub-carrier, excluding time-division multiplex | 2 |
| (4) A single channel containing analogue information | 3 |
| (5) Two or more channels containing quantized or digital information | 7 |
| (6) Two or more channels containing analogue information | 8 |
| (7) Composite system with one or more channels containing quantized or digital information, together with one or more channels containing analogue information ... | 9 |
| (8) Cases not otherwise covered ... | X |

(e) Third Symbol—type of information to be transmitted:²

- | | |
|---|---|
| (1) No information transmitted ... | N |
| (2) Telegraphy—for aural reception | A |
| (3) Telegraphy—for automatic reception | B |
| (4) Facsimile | C |
| (5) Data transmission, telemetry, telecommand | D |
| (6) Telephony (including sound broadcasting) | E |
| (7) Television (video) | F |
| (8) Combination of the above | W |
| (9) Cases not otherwise covered ... | X |

(f) Type B emission: As an exception to the above principles, damped waves are symbolized in the Commission's rules and regulations as type B emission. The use of type B emissions is forbidden.

(g) Whenever the full designation of an emission is necessary, the symbol for that emission, as given above, shall

modulation) should be designated under (2) or (3).

²In this context the word “information” does not include information of a constant, unvarying nature such as is provided by standard frequency emissions, continuous wave and pulse radars, etc.

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be preceded by the necessary bandwidth of the emission as indicated in § 2.202(b)(1).

[49 FR 48697, Dec. 14, 1984]

§ 2.202 Bandwidths.

(a) *Occupied bandwidth.* The frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission. In some cases, for example multi-channel frequency-division systems, the percentage of 0.5 percent may lead to certain difficulties in the practical application of the definitions of occupied and necessary bandwidth; in such cases a different percentage may prove useful.

(b) *Necessary bandwidth.* For a given class of emission, the minimum value of the occupied bandwidth sufficient to ensure the transmission of information at the rate and with the quality required for the system employed, under specified conditions. Emissions useful for the good functioning of the receiving equipment as, for example, the emission corresponding to the carrier of reduced carrier systems, shall be included in the necessary bandwidth.

(1) The necessary bandwidth shall be expressed by three numerals and one letter. The letter occupies the position of the decimal point and represents the unit of bandwidth. The first character shall be neither zero nor K, M or G.

(2) Necessary bandwidths:

between 0.001 and 999 Hz shall be expressed in Hz (letter H);

between 1.00 and 999 kHz shall be expressed in kHz (letter K);

between 1.00 and 999 MHz shall be expressed in MHz (letter M);

between 1.00 and 999 GHz shall be expressed in GHz (letter G).

(3) Examples:

0.002 Hz—H002	180.5 kHz—181K
0.1 Hz—H100	180.7 kHz—181K
25.3 Hz—25H3	1.25 MHz—1M25
400 Hz—400H	2 MHz—2M00
2.4 kHz—2K40	10 MHz—10M0
6 kHz—6K00	202 MHz—202M
12.5 kHz—12K5	5.65 GHz—5G65
180.4 kHz—180K	

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(c) The necessary bandwidth may be determined by one of the following methods:

(1) Use of the formulas included in the table, in paragraph (g) of this section, which also gives examples of necessary bandwidths and designation of corresponding emissions;

(2) For frequency modulated radio systems which have a substantially linear relationship between the value of input voltage to the modulator and the resulting frequency deviation of the carrier and which carry either single sideband suppressed carrier frequency division multiplex speech channels or television, computation in accordance with provisions of paragraph (f) of this section and formulas and methods indicated in the table, in paragraph (g) of this section;

(3) Computation in accordance with Recommendations of the International Radio Consultative Committee (C.C.I.R.);

(4) Measurement in cases not covered by paragraph (c) (1), (2), or (3) of this section.

(d) The value so determined should be used when the full designation of an emission is required. However, the necessary bandwidth so determined is not the only characteristic of an emission to be considered in evaluating the interference that may be caused by that emission.

(e) In the formulation of the table in paragraph (g) of this section, the following terms are employed:

B_n = Necessary bandwidth in hertz

B = Modulation rate in bauds

N = Maximum possible number of black plus white elements to be transmitted per second, in facsimile

M = Maximum modulation frequency in hertz

C = Sub-carrier frequency in hertz

D = Peak frequency deviation, i.e., half the difference between the maximum and minimum values of the instantaneous frequency. The instantaneous frequency in hertz is the time rate of change in phase in radians divided by 2

t = Pulse duration in seconds at half-amplitude

t_r = Pulse rise time in seconds between 10% and 90% of maximum amplitude

K = An overall numerical factor which varies according to the emission and which depends upon the allowable signal distortion.